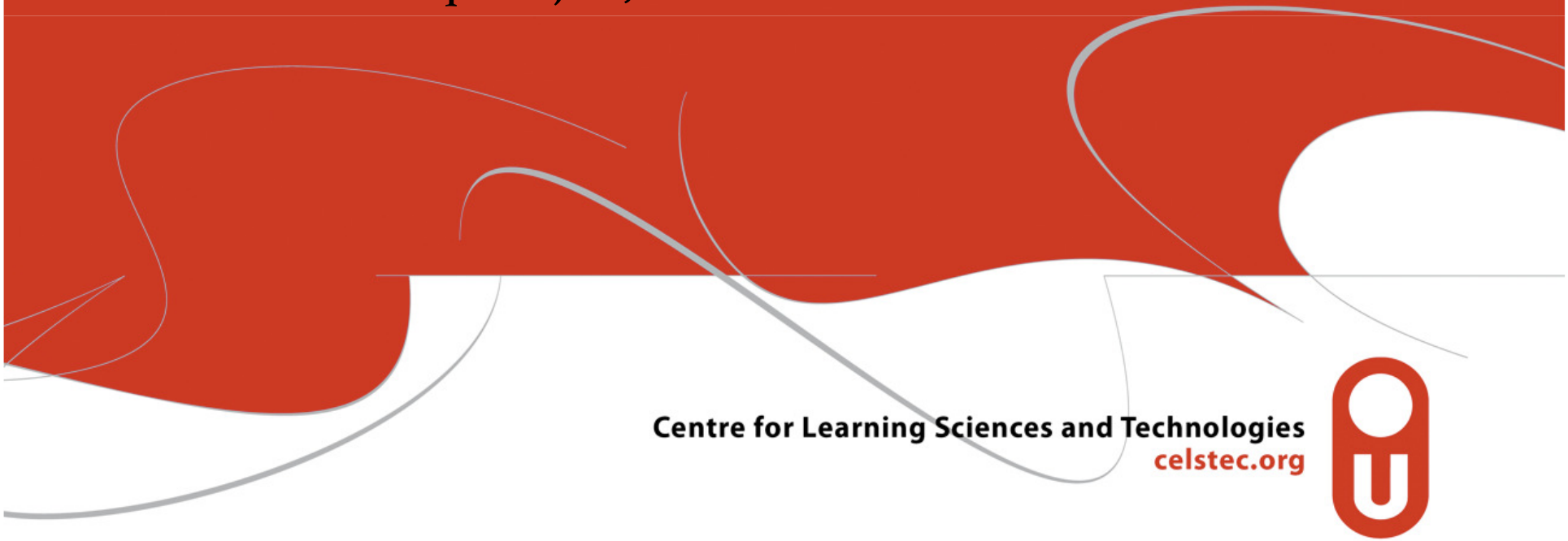
# Measurement Issues

# ICO theme Domain-specific Instruction

**Monique Bijker, PhD coordinator DS Instruction**



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# Overview

- Did we study our research object from a micro-, meso, or macro perspective?
- What is the relation between the **micro, meso, and macro levels of research** and the **levels of theories** as presented by Arthur Bakker?
- The consistency between theory (concepts), methods, and techniques
- The role of conceptual frameworks in different disciplines at different levels
- To which degree do the different levels of theories and methods affect our results?
- An example: the competency concept in the domain of BA.

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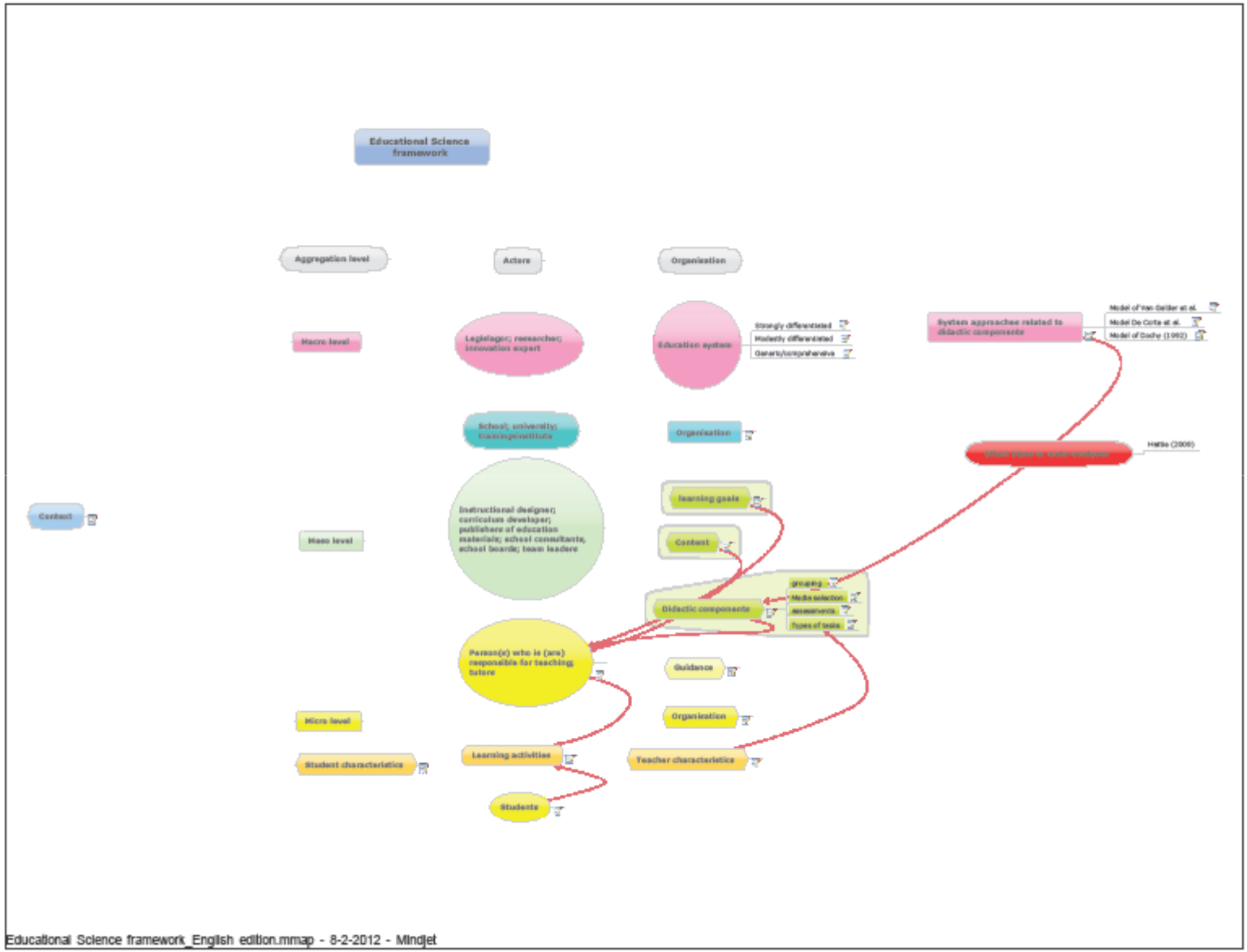
# The Educational Science Framework



# Group task nr 1

- Did you (or are you going to) study your research object from a micro-, meso, or macro perspective, or perhaps, from multiple levels?

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# Reminder layeredness of educational theories

- **'Grand theories'** (e.g. Piaget). How 'hard' are age-related stage theories? More evidence of stages available in expertise research?
- **Orienting frameworks** (e.g. constructivism; socio-cultural theories). What is the difference between constructivism and CCHs?
- **Frameworks of actions** (e.g. pedagogical strategies; e.g. build communities of learners, learning by designing). Are learning activities also part of frameworks of actions? Is learning part of a framework of actions?
- **Domain-specific instruction theories** (e.g. realistic math education). What is the relationship with authentic tasks?
- Are **ontological innovations** embedded in learning theories, developmental theories, teaching theories, instructional design theories, measurement theories, policy theories, economic theories? What are the differences/similarities?

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# Theory, methods, and techniques

- Research questions determine the research methods;
- Research questions are derived from theory. Hence, theory determines the research questions;
- Methods determine the statistics techniques which can be selected.

There should be coherence between the theory, methods, and techniques.

Mellenbergh (1980). Theory at different levels. *Nederlands Tijdschrift voor de Psychologie (35)*, 275-288.

# The role of key concepts and conceptual frameworks in different disciplines at different levels

- Concepts are overarching aggregations of facts – abstractions to understand specific parts of our world.
- Empirical concepts vs theoretical concepts
- Theoretical concepts are the instruments with which we make the interrelationships in reality conceivable (Heldring, 2009, p.158)

- Examples in natural science: force, speed, time, volume, weight, etc.
- Examples in educational science: knowledge; formal, informal and non formal learning; tasks; curricula, development; metacognition; schemata or mental maps; implementation of innovations, internationalization, etc.
- Examples in business administration: cash flow; turnover; gross sales; investments; capital costs; purchasing; management; costs- benefits.
- Examples in economics: markets; inflation; recession; human capital, etc.

# Concepts are instruments to operationalize and measure (a part of the) world

- Concepts are not directly observable. They have to be described and defined.
- Definitions lead to operationalizations – making concepts measurable, and empirically testable.

→ Hence, concepts define the **research methods (focussing on finding general laws or principles)**. To explain and predict.

- Methods in natural sciences: Experiments; observations
- Methods in educational science: Experiments; DBR; cross-sectional quantitative designs; longitudinal studies; descriptive, qualitative studies (observations); case studies; mixed models
- Methods in business administration: case studies; descriptive, qualitative studies; cross-sectional correlational studies; meta-analyses; few experiments
- Examples in economics: Quantitative large scale cross-sectional or longitudinal correlational studies.

# To which degree do methods and instruments affect our results?

# *Lifelong learning in the professions: how psychologists, educational scientists, and managers differ from each other*

*A comparison of three analyses using one and the same database*

# By

Cees van der Vleuten

Johan van Strien

Dirk Tempelaar

Boudewijn Kuperus

Monique Bijker

Marcel van der Klink

Isabelle Raemdonck

Els Boshuizen

# Three analyses: factors and correlations

| | EFA | CFA | Rasch |
|---|---|---|---|
| | 3 | 7 | 4 |
| 1 SDCC | X | XX | X |
| 2 SDLC | X | XX | X |
| 3 SE | X | XX | X |
| 4 SRLC | | X | X |

**Correlations**

Positive and significant, except for SDLC and SE according to EFA in BA.

In CFA BA has not been analyzed.

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# Three analyses: predictors

| | | GPA | | | ECTS | | |
|---|---|---|---|---|---|---|---|
| | | ES | PSY | BA | OW | PSY | BA |
| EFA | 1 SDCC | X | | | | | |
| | 2 SDLC | | | | | | |
| | 3 SE | | X | | X | | |
| | 4 SRLC | | | | | | |
| CFA | 1 SDCCA or B | | | | | | |
| | 2 SDLC **B** | X | (x) | | | | |
| | 3 SE**A** | (x) | X | | X | X | |
| | 4 SRLC | | | | | | |
| Rasch | 1 SDCC | | | | | | X |
| | 2 SDLC | | | | | | (x) |
| | 3 SE | X | X | | X | X | ((x)) |
| | 4 SRLC | | | | | | |

# Three analyses: differences between groups

| | EFA | CFA | Rasch |
|---|---|---|---|
| SDCC | | | X |
| SDLC | X | | X |
| SE | X | X | |
| SRLC | | X | X |

EFA no distinction between premaster/master
EFA and CFA analyzed differences in two instead of three professions.

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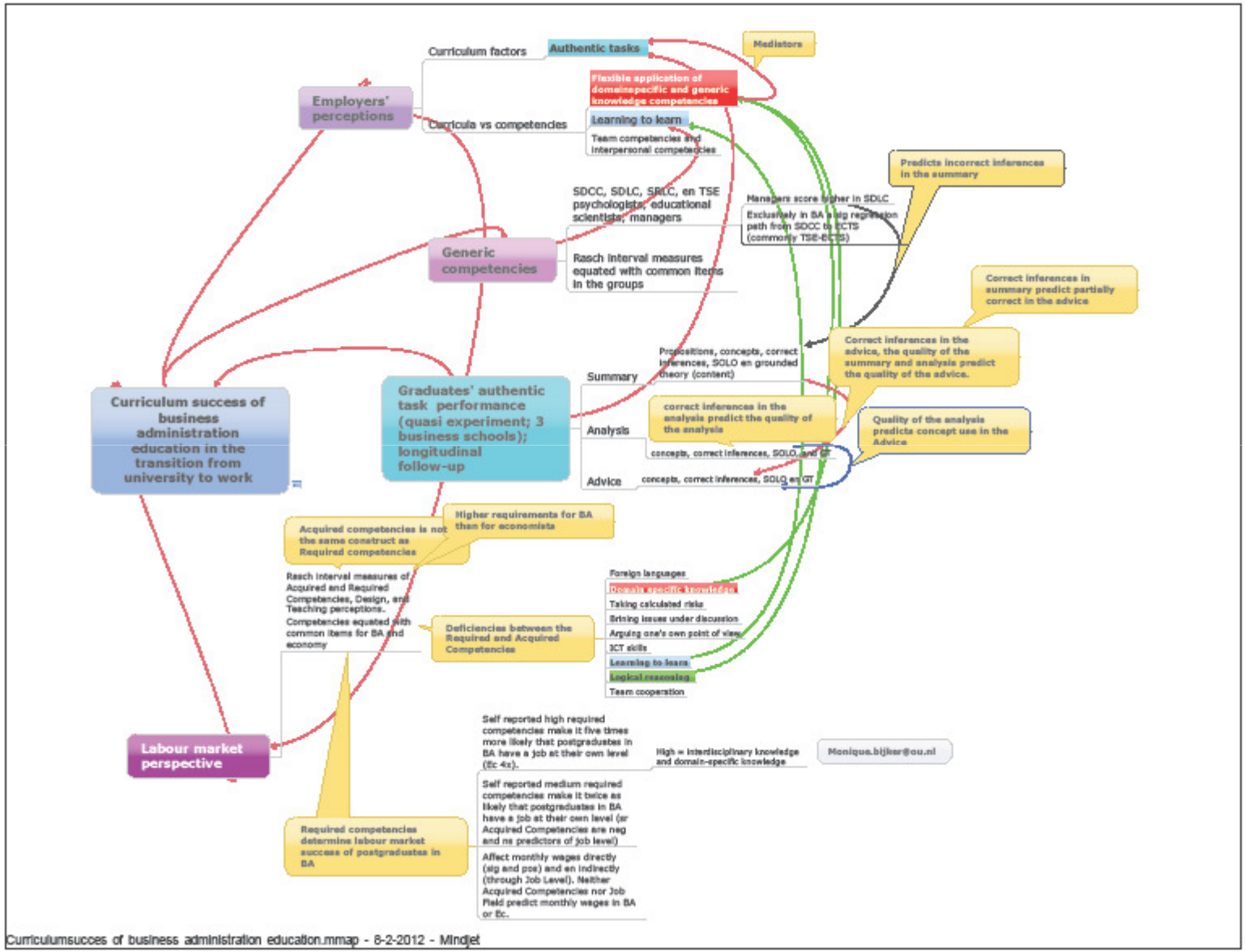
# Does it matter which method you choose?

# An example: the competency concept

Plays a role in

- Labour market theories - Indicators of economic growth – operationalized in wages
- Organization theory – operationalized in the key competencies of an corporation (comparative advantage).
- Educational science theories – integrated knowledge, skills, and attitudes. Operationalized in performances on authentic tasks. Triangulation. Multiple methods.
- Educational psychology - learning theories – behavioural and cognitive psychology. Operationalized in sustainable changes in the behavioural repertoire, or in the accumulation of declarative knowledge, procedural knowledge, or/and? conditional knowledge.
- Developmental psychology – operationalized in characteristics, belonging to certain stages (e.g. the Neo-Piagettian SOLO taxonomy).

# Competencies and different perspectives/levels



# Group task nr 2

- Which level(s) of theory (theories) and which specific theories are you using in your research project?
- Which concepts are your key concepts?

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# Thank you for your attention!

- **Questions?**

Monique.bijker@ou.nl